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SOLAR ECLIPSES, 1960 - 1963

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At the request of Commission 13 of the International Astronomical Union, the office of the American Ephemeris agreed to publish advance information on solar eclipses, computed from tabular positions of the Sun and Moon prepared for the purpose in the British Nautical Almanac Office. The data concerning the solar eclipses of 1957, 1958 and 1959 have been published in *U. S. Naval Observatory Circulars* Nos. 16, 40 and 53.

The present circular gives the results of the definitive calculations for all solar eclipses in 1960, 1961 and 1962, and for the total solar eclipse of 1963.

In conformity with the adoption of Ephemeris Time in the national ephemerides, beginning in 1960, the arguments are given here in Ephemeris Time (E. T.), and the longitudes are referred to the "Ephemeris meridian" as defined by D. H. Sadler, *Occasional Notes of the R. A. S.*, No. 17, vol. 3, 1954.

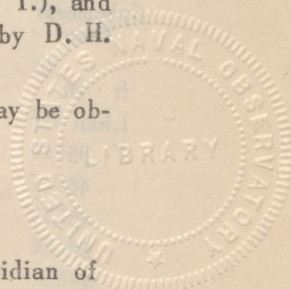
Once the value of ΔT is known, the accurate position of the track may be obtained very simply, and without interpolation, in the following manner:

Change all time—arguments into Universal Time by setting

$$UT = ET - \Delta T.$$

Leave latitudes unchanged, and refer the longitudes to the meridian of Greenwich by applying $-1.0027 \Delta T$ as a correction to the tabulated longitudes, remembering that a second of time is equivalent to 15 seconds of arc.

The value of ΔT can be accurately determined only in arrear. Past experience shows that a value estimated five years in advance may be in error by amounts up to 5 seconds. A predicted value, applicable to all data in this *Circular*, is +36 seconds of time.



PARTIAL ECLIPSE OF 1960 MARCH 27

In the eclipse of 1960 March 27, geocentric conjunction will occur in right ascension $0^{\text{h}} 24^{\text{m}} 16^{\text{s}}.45$ at E.T. $27^{\text{d}} 06^{\text{h}} 43^{\text{m}} 56^{\text{s}}.15$, the declination of the Sun being $+2^{\circ} 37' 28''.4$. The greatest eclipse will have the magnitude 0.699, at longitude $-151^{\circ} 49'$, latitude $-72^{\circ} 15'$. West longitudes are positive.

The eclipse will be observable in southern Australia, Tasmania, and the eastern half of Antarctica.

PARTIAL ECLIPSE OF 1960 SEPTEMBER 20 - 21

In the eclipse of 1960 September 20 - 21, geocentric conjunction will occur in right ascension $11^{\text{h}} 52^{\text{m}} 24^{\text{s}}.44$ at E.T. $20^{\text{d}} 22^{\text{h}} 15^{\text{m}} 58^{\text{s}}.36$, the declination of the Sun being $+0^{\circ} 49' 22''.4$. The greatest eclipse will have the magnitude 0.607, at longitude $+74^{\circ} 09'$, latitude $+72^{\circ} 11'$.

The eclipse will be observable in North America, excluding the section east of the Great Lakes, in the Aleutian Islands, and in eastern Siberia.

TOTAL ECLIPSE OF 1961 FEBRUARY 15

Ephemeris Time	Central Line		Duration on Central Line	Width of Path
	Latitude	Ephemeris Longitude		
h m	° '	° '	m s	mi
Limit	+ 46 32	+ 5 33		...
7 35	44 04.2	- 7 32.9	2 01.2	132
40	43 25.2	14 20.6	2 13.6	143
45	43 18.6	19 06.1	2 22.3	151
50	43 28.3	22 57.9	2 29.1	157
55	43 49.0	26 19.1	2 34.4	161
8 00	+ 44 18.3	- 29 20.9	2 38.6	163
05	44 55.0	32 09.7	2 41.6	164
10	45 38.3	34 50.3	2 43.7	164
15	46 28.1	37 25.9	2 44.9	162
20	47 24.4	39 59.5	2 45.1	160
25	+ 48 27.5	- 42 33.8	2 44.4	157

TOTAL ECLIPSE OF 1961 FEBRUARY 15 (*Continued*)

h m	° '	° '	m s	mi
8 30	+ 49 37.8	- 45 11.6	2 42.9	154
35	50 56.4	47 56.2	2 40.4	150
40	52 24.6	50 51.7	2 36.9	146
45	54 04.5	54 03.9	2 32.5	142
50	55 59.7	57 41.8	2 26.8	138
55	58 16.6	62 01.8	2 19.7	133
9 00	+ 61 09.1	- 67 40.0	2 10.6	128
05	65 22.6	76 42.8	1 57.4	122
Limit	+ 71 41	- 93 42	• • •	• • •

In the eclipse of 1961 February 15, geocentric conjunction will occur in right ascension $21^{\text{h}} 54^{\text{m}} 42^{\text{s}}.35$, at E.T. $15^{\text{d}} 08^{\text{h}} 43^{\text{m}} 04^{\text{s}}.5$, the declination of the Sun being $-12^{\circ} 42' 12''.1$.

ANNULAR ECLIPSE OF 1961 AUGUST 11

Ephemeris Time	Central Line		Duration on Central Line	Width of Path
	Latitude	Ephemeris Longitude		
h m	° '	° '	m s	mi
Limit	- 48 04	+ 39 02	• • •	• • •
9 55	45 15.7	28 06.5	5 46.0	308
10 00	- 44 01.3	+ 21 28.4	5 58.7	312
05	43 28.6	17 02.7	6 07.7	316
10	43 15.1	13 31.8	6 14.8	319
15	43 13.6	10 31.9	6 20.5	322
20	43 21.3	7 52.0	6 25.2	323
25	43 36.3	5 25.3	6 29.0	323
10 30	- 43 57.8	+ 3 09.0	6 31.8	322
35	44 25.0	+ 0 58.8	6 33.7	320
40	44 57.9	- 1 07.2	6 34.9	316
45	45 36.1	3 10.9	6 35.3	312
50	46 20.0	5 14.1	6 34.9	307
55	- 47 09.5	- 7 18.6	6 33.8	302

ANNULAR ECLIPSE OF 1961 AUGUST 11 (*Continued*)

h m	° '	° '	m s	mi
11 00	- 48 05.4	- 9 26.2	6 31.9	298
05	49 08.1	11 39.2	6 29.2	293
10	50 18.8	14 00.3	6 25.8	289
15	51 39.0	16 33.3	6 21.6	285
20	53 11.1	19 23.7	6 16.5	283
25	54 59.1	22 40.5	6 10.4	282
11 30	- 57 10.7	- 26 40.9	6 03.0	282
35	60 04.1	32 07.0	5 53.5	286
40	65 05.6	42 27.2	5 38.4	298
Limit	- 68 48	- 51 18	• • •	• • •

In the eclipse of 1961 August 11, geocentric conjunction will occur in right ascension $9^{\text{h}} 23^{\text{m}} 51^{\text{s}}.58$ at E.T. $11^{\text{d}} 11^{\text{h}} 09^{\text{m}} 42^{\text{s}}.3$, the declination of the Sun being $+15^{\circ} 16' 27''.3$.

TOTAL ECLIPSE OF 1962 FEBRUARY 4 - 5

Ephemeris Time	Central Line		Duration on Central Line	Width of Path
	Latitude	Ephemeris Longitude		
h m	° '	° '	m s	mi
Limit	+ 0 35	- 115 51	• • •	• • •
22 35	- 3 13.5	129 38.8	1 52.1	62
40	4 51.0	136 26.8	2 10.0	68
45	5 50.1	141 13.6	2 24.2	71
50	6 30.4	145 04.3	2 36.7	74
55	6 58.6	148 21.0	2 47.9	77
23 00	- 7 18.0	- 151 14.6	2 58.2	79
05	7 30.5	153 51.1	3 07.8	81
10	7 37.4	156 14.4	3 16.5	83
15	7 39.5	158 27.4	3 24.6	84
20	7 37.4	160 31.9	3 32.0	86
25	- 7 31.6	- 162 29.3	3 38.8	87

TOTAL ECLIPSE OF 1962 FEBRUARY 4 - 5 (*Continued*)

h	m	°	'	°	'	m	s	mi
23	30	-	7 22.5	-	164 21.0	3	44.8	88
	35		7 10.3		166 07.7	3	50.2	89
	40		6 55.1		167 50.2	3	54.9	89
	45		6 37.2		169 29.3	3	58.8	90
	50		6 16.8		171 05.4	4	02.1	91
	55		5 53.9		172 39.0	4	04.6	91
0	00	-	5 28.5	-	174 10.7	4	06.5	91
	05		5 00.9		175 40.8	4	07.6	91
	10		4 30.9		177 09.8	4	08.0	91
	15		3 58.6	-	178 38.0	4	07.7	91
	20		3 24.1	+	179 54.1	4	06.7	91
	25		2 47.3		178 26.3	4	05.1	91
0	30	-	2 08.1	+	176 58.0	4	02.8	90
	35		1 26.5		175 28.8	3	59.8	90
	40	-	0 42.5		173 58.3	3	56.2	89
	45	+	0 04.1		172 26.0	3	51.9	88
	50		0 53.4		170 51.1	3	47.1	88
	55		1 45.5		169 13.1	3	41.7	87
1	00	+	2 40.7	+	167 31.2	3	35.7	86
	05		3 39.4		165 44.4	3	29.2	85
	10		4 41.7		163 51.4	3	22.0	84
	15		5 48.3		161 50.6	3	14.3	82
	20		6 59.7		159 40.1	3	06.0	81
	25		8 17.0		157 17.0	2	57.0	79
1	30	+	9 41.3	+	154 37.0	2	47.4	77
	35		11 14.7		151 33.7	2	36.8	75
	40		13 00.9		147 55.7	2	25.0	72
	45		15 06.9		143 19.9	2	11.5	69
	50		17 53.3		136 38.7	1	54.4	64
Limit		+	22 53	+	121 58	• • •		• • •

In the eclipse of 1962 February 4 - 5, geocentric conjunction will occur in right ascension $21^{\text{h}} 12^{\text{m}} 42^{\text{s}}.99$ at E.T. $5^{\text{d}} 00^{\text{h}} 17^{\text{m}} 03^{\text{s}}.8$, the declination of the Sun being $-16^{\circ} 07' 35''.5$.

ANNULAR ECLIPSE OF 1962 JULY 31

Ephemeris Time	Central Line		Duration on Central Line	Width of Path
	Latitude	Ephemeris Longitude		
h m	° '	° '	m s	mi
Limit	+ 2 32	+ 67 01	• • •	• • •
10 35	6 57.8	53 33.5	2 57.1	88
40	8 53.4	47 20.6	3 00.8	84
45	10 09.8	42 55.8	3 03.9	81
50	11 06.6	39 22.1	3 06.8	78
55	11 50.7	36 19.6	3 09.4	76
11 00	+ 12 25.7	+ 33 38.6	3 11.9	74
05	12 53.4	31 13.3	3 14.3	73
10	13 15.3	29 00.2	3 16.5	71
15	13 32.2	26 56.9	3 18.7	70
20	13 44.8	25 01.5	3 20.7	69
25	13 53.5	23 12.8	3 22.6	68
11 30	+ 13 58.7	+ 21 29.6	3 24.3	67
35	14 00.8	19 51.2	3 25.9	67
40	13 59.9	18 16.9	3 27.4	66
45	13 56.2	16 46.0	3 28.6	66
50	13 49.9	15 18.3	3 29.7	65
55	13 41.2	13 53.2	3 30.7	65
12 00	+ 13 30.1	+ 12 30.4	3 31.5	64
05	13 16.7	11 09.5	3 32.1	64
10	13 01.1	9 50.2	3 32.5	64
15	12 43.3	8 32.3	3 32.7	64
20	12 23.4	7 15.5	3 32.8	64
25	12 01.4	5 59.5	3 32.7	64
12 30	+ 11 37.4	+ 4 44.1	3 32.5	64
35	11 11.2	3 29.0	3 32.0	64
40	10 43.0	2 13.9	3 31.5	64
45	10 12.7	+ 0 58.7	3 30.8	64
50	9 40.2	- 0 17.1	3 29.9	65
55	9 05.5	1 33.6	3 29.0	65
13 00	+ 8 28.6	- 2 51.4	3 28.0	65
05	7 49.3	4 10.6	3 26.8	66
10	7 07.6	5 31.8	3 25.5	67
15	6 23.3	6 55.4	3 24.2	67
20	5 36.2	8 22.0	3 22.8	68
25	+ 4 46.1	- 9 52.2	3 21.3	69

ANNULAR ECLIPSE OF 1962 JULY 31 (*Continued*)

h m	° '	° '	m s	mi
13 30	+ 3 52.8	- 11 27.0	3 19.8	70
35	2 55.9	13 07.3	3 18.2	72
40	1 54.9	14 54.5	3 16.5	73
45	+ 0 49.2	16 50.2	3 14.8	74
50	- 0 22.0	18 56.9	3 13.0	76
55	1 40.0	21 18.0	3 11.2	78
14 00	- 3 06.6	- 23 58.7	3 09.2	80
05	4 45.0	27 08.0	3 07.1	83
10	6 41.3	31 03.3	3 04.8	86
15	9 11.1	36 29.7	3 02.0	90
20	14 42.5	50 45.7	2 56.7	100
Limit	- 14 57	- 51 30	• • •	• • •

In the eclipse of 1962 July 31, geocentric conjunction will occur in right ascension $8^{\text{h}} 40^{\text{m}} 54^{\text{s}}.26$ at E.T. $31^{\text{d}} 12^{\text{h}} 27^{\text{m}} 37^{\text{s}}.3$, the declination of the Sun being $+18^{\circ} 19' 05''.5$.

TOTAL ECLIPSE OF 1963 JULY 20

Ephemeris Time	Central Line		Duration on Central Line	Width of Path
	Latitude	Ephemeris Longitude		
h m	° '	° '	m s	mi
Limit	+ 43 06	- 142 12	• • •	• • •
19 15	45 06.1	147 06.5	0 36.4	36
20	50 41.4	161 02.2	0 51.2	46
25	53 33.0	168 48.6	0 59.5	50
19 30	+ 55 39.9	- 175 13.1	1 06.2	53
35	57 20.9	+ 178 59.8	1 11.8	55
40	58 43.4	173 33.0	1 16.7	57
45	59 51.0	168 18.0	1 21.0	58
50	60 45.9	163 10.5	1 24.8	59
55	+ 61 29.5	+ 158 08.0	1 28.1	60

TOTAL ECLIPSE OF 1963 JULY 20 (Continued)

h	m	°	'	°	'	m	s	mi
20	00	+	62 02.7	+	153 09.6	1	30.9	61
	05		62 26.1		148 15.1	1	33.4	61
	10		62 40.3		143 24.8	1	35.4	62
	15		62 45.8		138 39.4	1	37.0	62
	20		62 42.9		133 59.7	1	38.3	63
	25		62 32.1		129 26.6	1	39.2	63
20	30	+	62 13.8	+	125 00.8	1	39.6	63
	35		61 48.3		120 42.8	1	39.7	63
	40		61 16.0		116 33.0	1	39.4	63
	45		60 37.2		112 31.3	1	38.7	63
	50		59 52.2		108 37.7	1	37.7	63
	55		59 01.2		104 51.5	1	36.2	63
21	00	+	58 04.4	+	101 12.0	1	34.4	62
	05		57 01.8		97 38.4	1	32.2	62
	10		55 53.4		94 09.2	1	29.7	61
	15		54 39.1		90 43.1	1	26.7	60
	20		53 18.5		87 18.0	1	23.4	60
	25		51 51.1		83 51.5	1	19.6	58
21	30	+	50 15.9	+	80 20.5	1	15.4	57
	35		48 31.4		76 40.5	1	10.6	55
	40		46 35.3		72 44.6	1	05.2	53
	45		44 22.9		68 21.0	0	59.1	50
	50		41 44.4		63 04.8	0	51.7	46
	55		38 07.6		55 35.3	0	41.6	39
Limit		+	33 02	+	43 42	• • •		• • •

In the eclipse of 1963 July 20, geocentric conjunction will occur in right ascension $7^{\text{h}} 57^{\text{m}} 50^{\text{s}}.11$ at E.T. $20^{\text{d}} 20^{\text{h}} 29^{\text{m}} 10^{\text{s}}.7$, the declination of the Sun being $+20^{\circ} 41' 05''.5$.